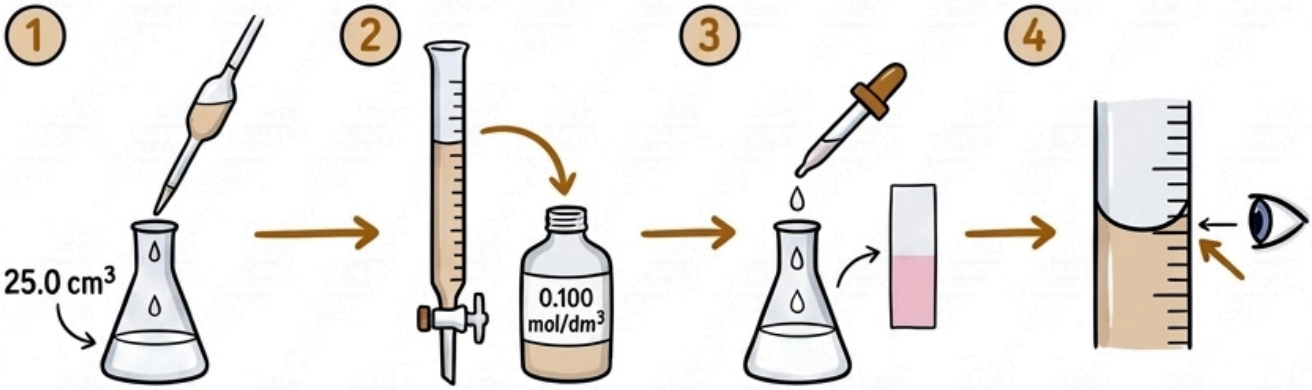
TITRATION

WHAT TITRATION IS:
A way to find an unknown concentration by reacting it with a solution whose concentration you already know.

WHY IT MATTERS:
It turns a colour change into a hard number, so labs can measure acidity, purity and dosage.

SETTING UP

Everything you measure out before a single drop is added



THE ANALYTE
The solution of unknown concentration. A pipette measures an exact volume into a conical flask.

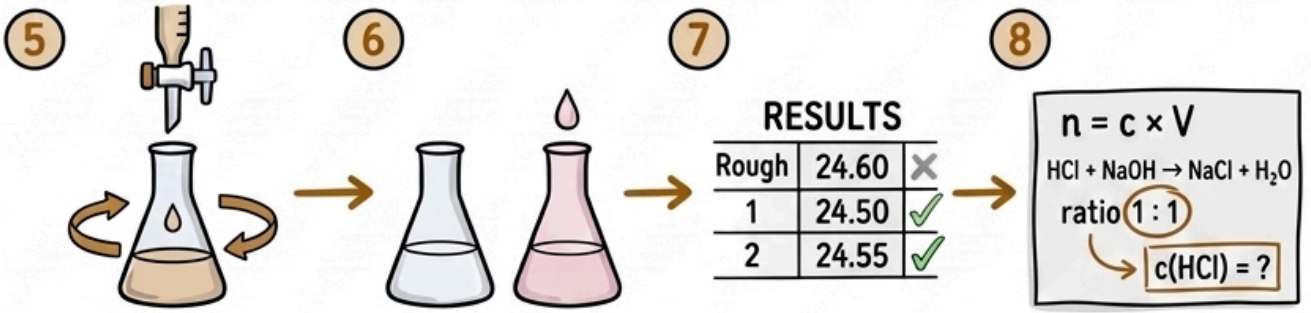
THE STANDARD
A solution whose concentration is known exactly. It goes in the burette is called the titrant.

THE INDICATOR
Two or three drops of a dye that changes colour sharply when the reaction is complete.

FIRST READING
Record the starting burette volume before you begin, reading the bottom of meniscus at eye level.

FINDING THE ANSWER

How the colour change becomes a concentration



ADD AND SWIRL
Run the titrant in while swirling the flask, then slow to one drop at a time near the end.

THE ENDPOINT
The first permanent colour change. One extra drop is all it takes to tip it over.

THE TITRE
Final reading minus first reading. Repeat until two results agree within 0.10 cm3.

THE MATHS
Moles equal concentration times volume. The balanced equation gives the ratio that unlocks the unknown.

How Titration Works

Most students think a titration is about the colour change.

The colour change is the least interesting part. It is just a timer going off.

A titration is a counting exercise. You cannot count molecules directly, so you react them against molecules you can count, and let the reaction do the arithmetic for you.

Here is the mental model you should have:

- You have a flask of something whose concentration you do not know
- You have a burette of something whose concentration you know exactly
- You add the known to the unknown until the reaction is exactly complete
- The indicator does one job only, it tells you when to stop
- The volume you added is the measurement, everything else is setup
- The balanced equation converts that volume into the answer

The mistake almost everyone makes is treating the endpoint as the answer. It is not. The endpoint is where you stop measuring. The answer comes from the balanced equation, because the mole ratio is what connects what you added to what was there.

That is also why a 2:1 ratio catches so many people out. The reading looks fine, the colour looks perfect, and the number is still wrong by a factor of two.

A chemist thinks about it in reverse. Before touching any glassware they already know the balanced equation, so they know exactly what the titre is going to be used for. The practical work is just collecting one number reliably enough to trust it, which is the real reason you repeat until two results agree within 0.10 cm3.

One drop is roughly 0.05 cm3. On a 25 cm3 titre, that single drop is a 0.2 percent error. Your glassware is almost always more precise than your patience.

What is the first thing you check when a titration gives you an answer that is exactly double what you expected?